Check List 8(3): 469-490, 2012
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ISSN 1809-127X (available at *www.checklist.org.br*)

Check List
Journal of species lists and distribution

LISTS OF SPECIES

Amphibians and Reptiles of Luzon Island (Philippines), VII: Herpetofauna of Ilocos Norte Province, Northern Cordillera Mountain Range

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ABSTRACT: We report new distribution records for amphibians and reptiles from 20 localities within the northern Cordillera Mountain Range of Ilocos Norte Province, Luzon Island, Philippines. Together with opportunistic collections of specimens from past surveys, our new data result in a total of 58 amphibian and reptile species for Ilocos Norte Province and the extreme northern Cordilleras—all of which constitute major geographic range extensions. We utilize new data and IUCN formalized conservation assessment criteria to revise the conservation status of many species. Our results highlight the degree to which fundamental distribution data are lacking for Luzon amphibians and reptiles and emphasize the manner in which many current species assessments are based on incomplete data and, as a result, may be sorely misleading. The complex biogeography of Luzon's herpetofauna remains poorly understood, providing opportunities for future research and conservation efforts once distribution patterns and local abundances are properly documented.

INTRODUCTION

The northern Philippine island of Luzon supports a diverse amphibian and reptile fauna (Inger 1954; Brown and Alcala 1970; Brown 2007; Siler *et al.* 2011a; Diesmos and Brown 2011) that remains poorly known despite many historical taxonomic studies (Taylor 1920a, b, 1921; 1922a, b, c, d, e; 1923; Inger 1954; Leviton 1962; 1963a, b; 1964a, b; 1965a, b; 1967; 1970; Brown and Alcala 1974; 1980), and a few intensive faunistic surveys conducted at selected sites (Brown *et al*. 1996; 2000a; Diesmos *et al.* 2005; Siler *et al.* 2011a; McLeod et al, 2011; Devan-Song and Brown 2012).

Montane microendemism on the island's distinct geological components has become an expectation (Taylor 1922a; Brown *et al.* 2002) borne out by a wealth of empirical studies (Alcala *et al.* 1998; R. Brown *et al*. 1996; 1999; 2000a, b; 2007; 2010a; W. Brown *et al*. 1997a, b, c; 1999a, b; Diesmos 1998; Diesmos *et al.* 2005; Siler *et al.* 2009; Siler and Brown 2010; Fuiten *et al*. 2011). Biogeographers now assume that patterns of localized species distributions within Luzon are related to several key factors associated with geography, atmospheric variation, recent climatic fluctuations, and ancient geological events (reviewed in Brown and Diesmos 2009). These include numerous periods of isolation, afforded during recent times (mid- to late Pleistocene), by cyclical sea level, atmospheric, and floral community composition fluctuations that accompanied glacial–interglacial cycles of the past two million years (Brown and Diesmos 2002; 2009). Additionally, it is clear that more ancient periods of isolation gave rise to "old endemics" of Luzon (Brown *et al*. 1996; 2000a, b; 2010a; Esselstyn and Brown, 2009; Welton et al., 2010; Linkem et al., 2011; Siler *et al*. 2011a, b; 2012) on separate paleoisland precursors that have only recently accreted into the Luzon Island of today (Auffenberg 1988; Defant *et al.* 1989; Yumul *et al.* 2003; 2009; Hall 1996; 1998; Brown and Diesmos 2009). Finally, a more recent body of work has documented convoluted patterns of biogeography on Luzon, with repeated bouts of colonization and faunal exchange between Luzon, Mindoro, Visayan (central) islands, and even the northern edge of the Mindanao faunal region (northern Samar Island), giving rise to an assembled fauna of varying and unpredictable systematic affinities (Brown and Diesmos 2009; Esselstyn *et al*. 2009; Linkem *et al.* 2010; Siler *et al*. 2011b, c).

One poorly understood component of Luzon's amphibian and reptile fauna is the amphibian and reptile communities of the northern regions of the Cordillera Mountains (Ilocos Norte, Apayao, Abra and Kalinga Provinces; Figure 1). Although visited briefly by E. H. Taylor in April 1920, and recognized as harboring numerous species with ranges apparently restricted to the northern Cordillera (Taylor 1922a, b, c; 1923), no synthetic work has yet been presented to summarize the unique assemblage of herpetological species in this area. Only a single study from a high elevation site in Kalinga Province (Balbalan-Balbalasang National Park; Diesmos *et al*. 2005) has been published since the work of Taylor, and no faunal studies have described low- to mid-elevation herpetological communities, nor synthetically reviewed the faunas of the extreme northern end of the Cordillera Mountains (but see Ota and Ross 1994; Brown *et al*. 2008; 2009; and Oliveros *et al.* 2011, for faunal studies of the islands just north of Luzon). Although Taylor described a total of nine species that appeared unique to the area (Taylor 1920; 1922a,

b, c; 1923; 1925; 1963), the subject of a range-restricted Cordillera amphibian and reptile community has not yet been considered, except in passing during the descriptions of several new species derived from the Diesmos *et al.* (2005) surveys (Wallach *et al.* 2007; Brown *et al.* 2010a, b).

In this paper we present results of the first intensive herpetological surveys conducted in Ilocos Norte Province, northwest Luzon. We include species accounts for our own data from surveys at nine sites and summarize all available historical museum records from five additional areas from which past collections were taken in Ilocos Norte Province. Finally, we canvassed museum collections for information from the surrounding provinces and report these records to provide biogeographical context for our report. These new data provide an ideal opportunity to review and, in many cases, revise the formal conservation status (IUNC 2010; 2011) of all included species. This paper represents the first attempt to synthetically review the herpetofauna of Ilocos Norte Province and to consider the unique assemblage of amphibian and reptile species inhabiting the mountains of extreme northwest Luzon Island.

Materials and Methods

The collections summarized in this inventory consist of new distribution records for Ilocos Norte Province, and, in some cases, surrounding provinces (Figure 1). From May–June, 2011, a large team of biologists visited Ilocos Norte Province and conducted biodiversity surveys in the mountains surrounding the Municipality of Adams (Figures 2–14). The following sites were surveyed for herpetofauna (cordinate datum type = WGS 84), Location 1: 720–750 m elevation, Mt. Pao, Barangay Adams, Municipality of Adams (18.438° N, 120.878° E; surveyed by us on 15–20 June, 2011; Figures 6–11); Location 2: 1,150–1,200 m elevation, Mt. Pao, Barangay Adams, Municipality of Adams (18.430° N, 120.859° E; surveyed by us on 19–23 June, 2011; Figures 12, 13); Location 3: 350-400 m elevation, Adams Town Proper, Barangay Adams, Municipality of Adams (18.460° N, 120.910° E; surveyed by us on 23–25 June, 2011; Figures 3, 4); Location 4: 475–510 m elevation, Mt. Pao, Barangay Adams, Municipality of Adams (18.449° N, 120.894° E; surveyed by us on 25 June–1 July, 2011; Figure 4); Location 5: sea level, Municipality of Bangui, northwest coast of Luzon (18.533° N, 120.766° E; surveyed by E. H. Taylor, June 1919); Location 6: Municipality of Currimao, west coast of north Luzon (18.006° N, 120.510° E; visited by G. F. Lopez, date unknown); Location 7: Municipality of Solsona, east of Laoag City (18.099° N, 120.765° E; visited by G. H. Lopez, April 1934); Location 8: vicinity of Santa Praxedes, coastal road along N. Luzon coast, at approximate boundary between Ilocos Norte and Cagayan

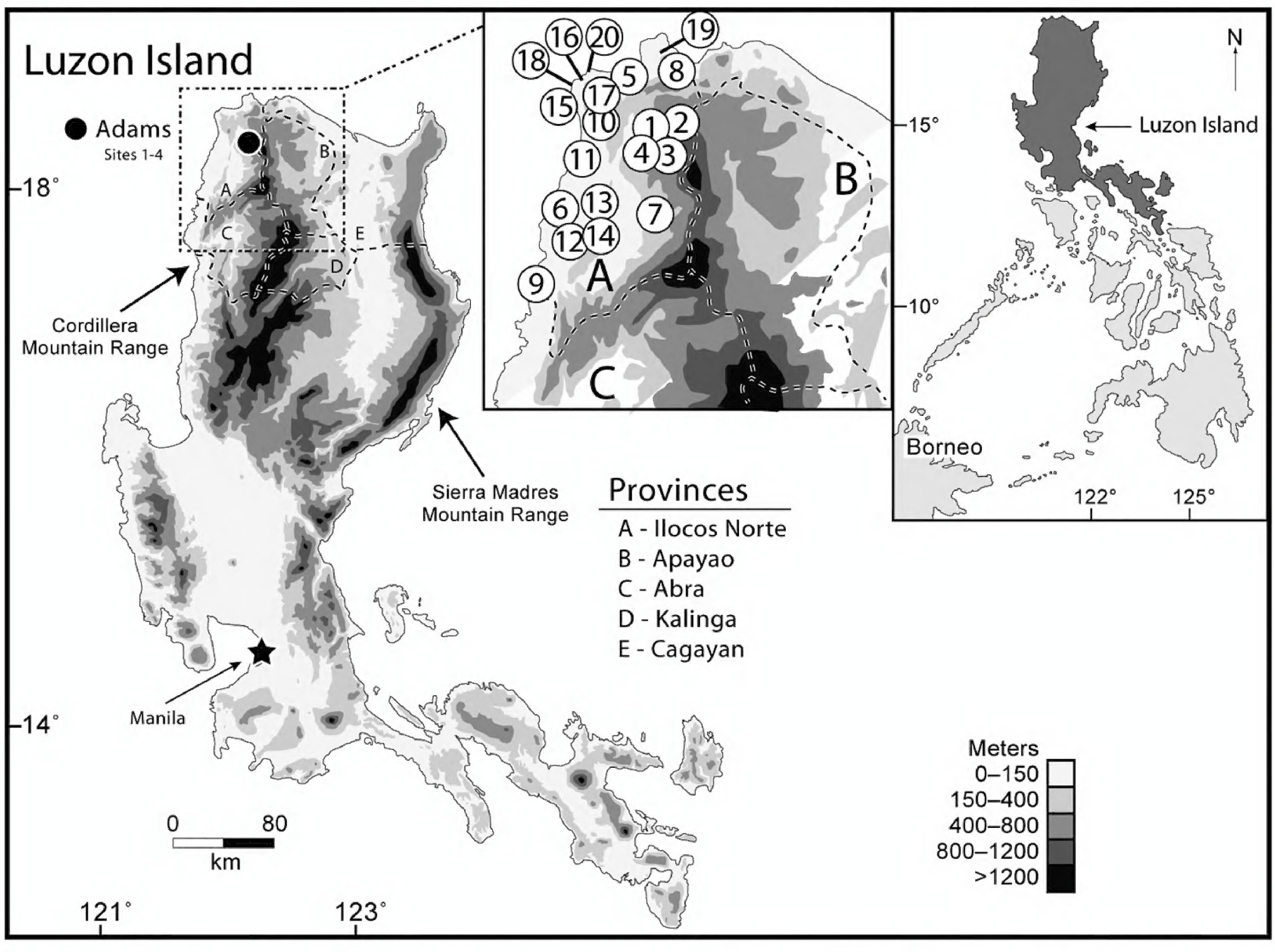

Figure 1. Map of northwestern Luzon Island, Philippines. Elevation contours are indicated with darkened incremental shading. On the left panel, the general position of the Municipality of Adams is marked with a large black dot (encompassing sampled localities 1–4 on middle panel). Middle: close-up of Ilocos Norte Province, with each sampling locality marked with numbered circles, corresponding to localities listed in the Materials and Methods. Provincial boundaries are indicated with dashed lines. The inset (at right) shows the location of Luzon Island (darkly shaded) within the Philippines.

Provinces (18.583° N, 120.988° E; surveyed by RMB and ACD, May 2000); Location 9: Municipality of Cabugao (17.813° N, 120.438° E); Location 10: Danao Barrio, 18 km NE of Vintar City, Municipality of Vintar (18.273° N, 120.592 E; surveyed by C. A. Ross and M. Lorenzo, 1985); Location 11: Barangay Santa Maria, La Paz Road, Municipality of Laoag, Laoag City (18.200° N, 120.579 E; surveyed by ACD and MLDD, 29 August–1 September, 2011); Location 12: Barangay 25, Municipality of San Matias, Laoag City (18.199° N, 120.600 E; surveyed by ACD and MLDD, 29 August–1 September, 2011); Location 13: Barangay Nagbalacan, Municipality of Batac (18.011° N, 120.631 E; surveyed by ACD and MLDD, 29 August–1 September, 2011); Location 14: Barangay Barong, Municipality of Dingras (18.117° N, 120.700 E; surveyed by ACD and MLDD, 29 August–1 September, 2011); Location 15: Barangay Tulnagan, Municipality of Pasuquin (18.333° N, 120.617° E; Location 16: Barangay Bobon, Municipality of Burgos (18.348° N, 120.647° E); Location 17: Barangay Paayas, Municipality of Burgos (18.335° N, 120.629° E); Location 18: Barangay Magarutung, Municipality of Davila (18.477° N, 120.582° E) (Locations 15–19 surveyed by R. V. Sison, between February and October, 1985); Location 19: Barangay Pansian, Municipality of Pagudpud (18.588° N, 120.826° E; surveyed by ACD and RMB, August 2002); Location 20: Barangay Pao, Municipality of Burgos (18.527° N, 120.640° E; surveyed by R. V. Sison, 1985). Finally, a few records reported here correspond to specimens deposited in PNM withour precise locality data (i.e., "Ilocos Norte Province" only; C. A. Ross collections, 1985).

Figure 2. View of Adams from the west, approximately 300 m in elevation, from the foothills of Mt. Pao. Photo by RMB.

Figure 3. View of Adams (to the northwest) from foothills east of town. Photo by RMB.

Figure 4. View (to the southeast) of the southern end of the Municipality of Adams, from foothills east of town. Mt. Pao is visible at right. Photo by RMB.

Figure 5. View of the mountains north of Adams. Photo by RMB.

Figure 6. Typical characteristics of streamside vegetation at Location 1. Photo by RMB.

Figure 7. Dry stream bed habitat at Location 1. Photo by RMB.

Figure 8. Small forested river near Location 1. Photo by P. Hosner.

Figure 9. Forest view on ridge above Location 1, approximately 800 m asl, Mt. Pao. Photo by P. Hosner.

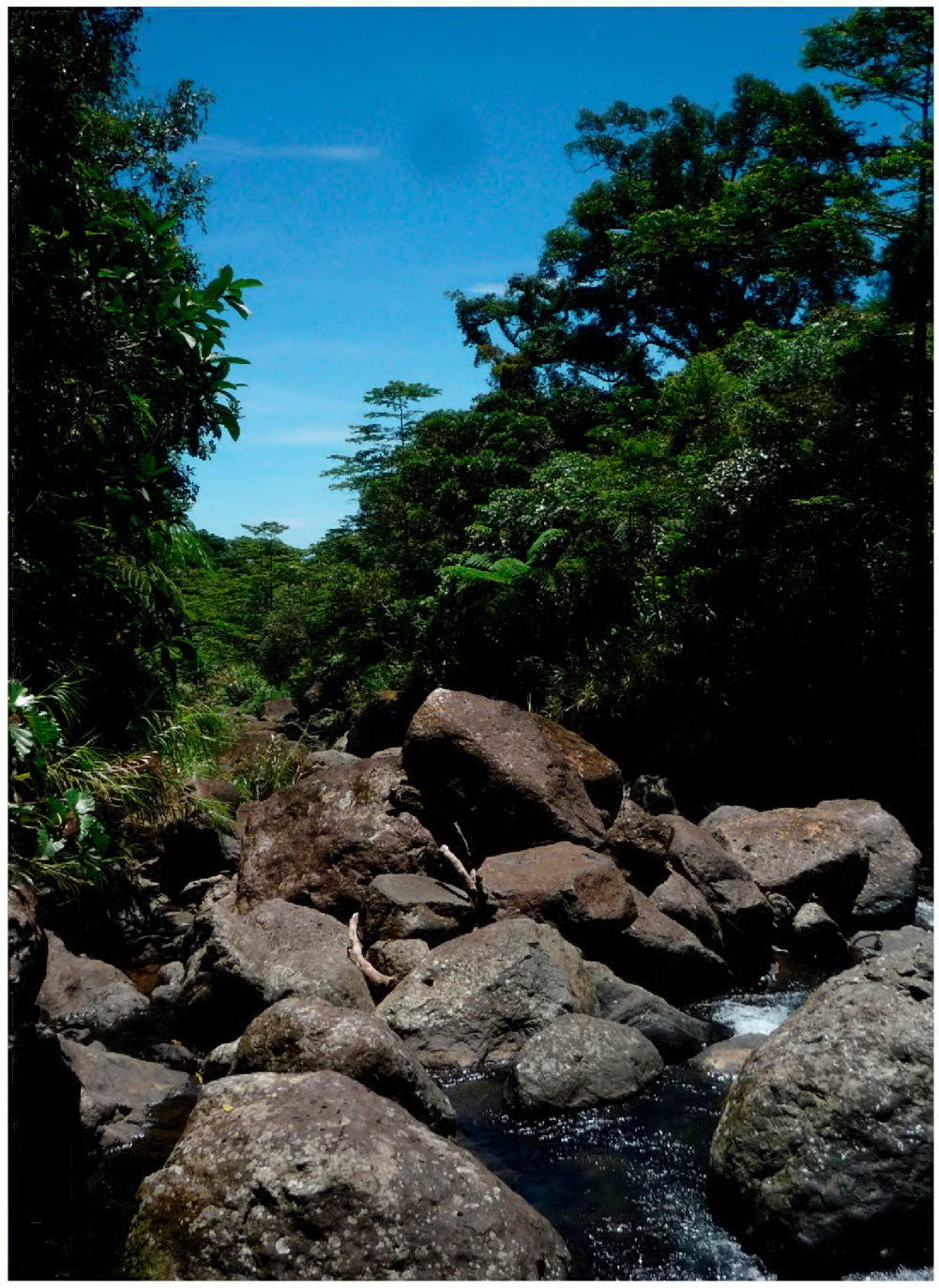

Figure 10. Large boulders in riverbed below Location 1 (typical preferred habitat of *Sanguirana igorota*). Photo by P. Hosner

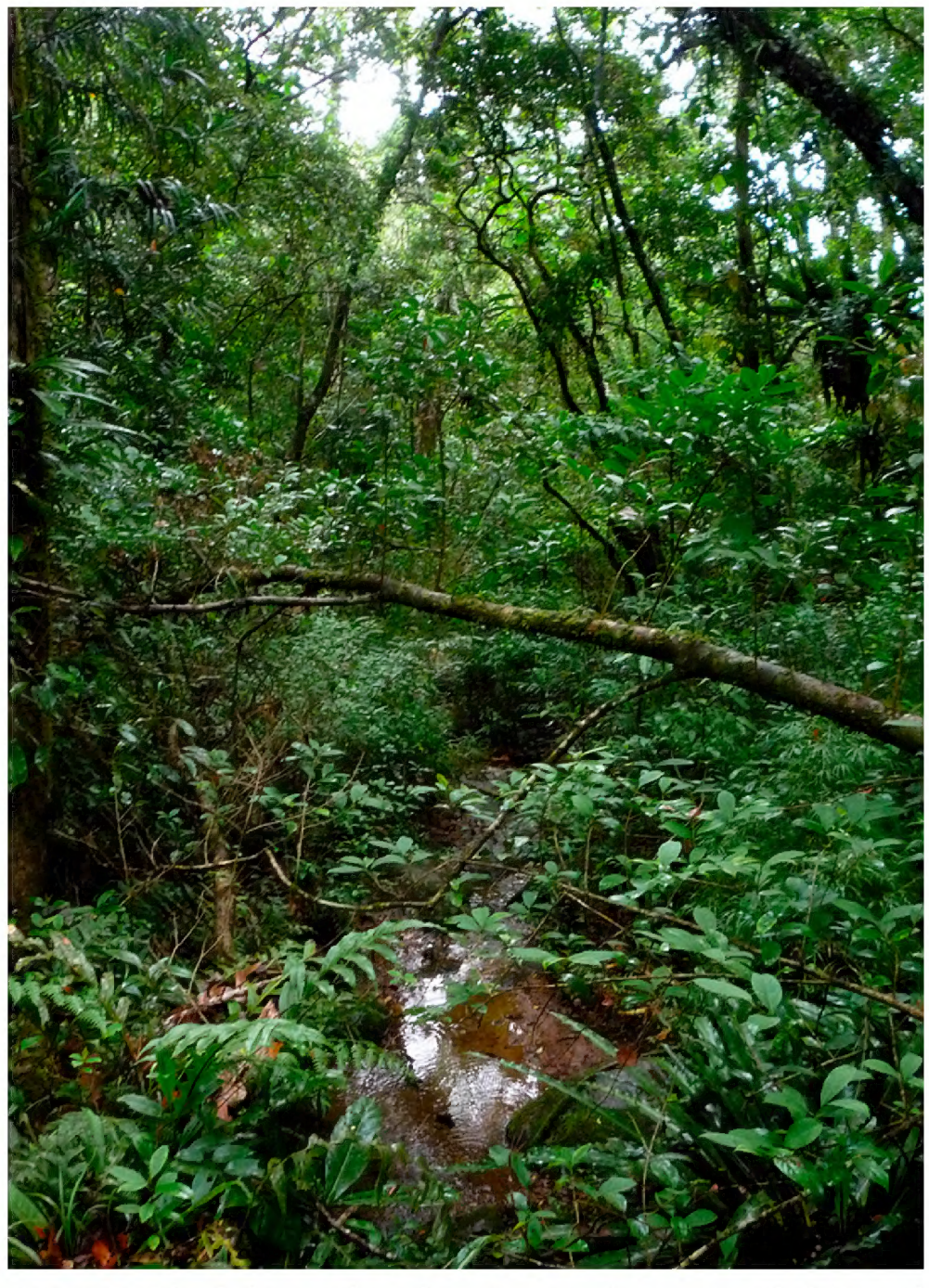

Figure 11. Flooded forest floor above Location 1, aproximately 850 m asl on Mt. Pao. Photo by P. Hosner.

FIGURE 12. View of the northern Cordilleras from Location 2. Photo by P. Hosner.

FIGURE 13. Closed-canopy forest characteristics at Location 2. Photo by P. Hosner.

FIGURE 14. Agricultural clearing near Location 4. Photo by P. Hosner.

Catalog numbers corresponding to voucher specimens (deposited at the University of Kansas Natural History Museum and Biodiversity Institute [KU], the California Academy of Sciences [CAS], the Carnegie Museum [CM], the Smithsonia Institute [USNM], and National Museum of the Philippines [PNM]) are included below whenever possible. Field surveys followed protocols enumerated in a Memorandum of Agreement (MOA) between the University of Kansas and the Protected Areas and Wildlife Bureaeu (PAWB) of the Philippine Department of Environment and Natural Resources (DENR), as outlined in a Gratuitous Permit to Collect (GP) biological specimens, No. 201, administered by PAWB for 2010–2011. Based on our own data, results of previous work, our past experience with IUCN conservation status assessments (IUCN 2010), and the formal criteria for assessing species threat categories (IUCN 2011), we revise the conservation status for many of the taxa included in this report.

RESULTS AND DISCUSSION

We document the presence of 58 species of amphibians and reptiles from Ilocos Norte Province (24 frogs, 17 lizards, 16 snakes, and one turtle). Fifty-six of these represent new provincial records and all constitute major range extensions for the species involved (Table 1). Below we provide species accounts and notes on natural history and, in some cases, provide a revised conservation status assessment (with full justification) based on IUCN categories (IUCN 2011), for each taxon.

Species Accounts

AMPHIBIA

BUFONIDAE

Rhinella marina (Linnaeus, 1758)

This introduced species occurs throughout the archipelago on most islands and is widespread on Luzon (Diesmos *et al.* 2006). As in many sites throughout the archipelago (Inger 1954; Brown and Alcala 1970; Alcala and Brown 1998; Diesmos *et al.* 2006), this species is abundant in and around residential areas and surrounding agricultural fields on the outskirts of Laoag City and in many other areas of Ilocos Norte Province. This invasive species' conservation status is classified as "Least Concern" (LC; IUCN 2010). Locations 11–14: Specimens deposited in PNM.

CERATOBATRACHIDAE

Platymantis cagayanensis Brown, Alcala, and Diesmos, 1999

Originally described from Santa Praxedes along the north coast of Luzon in Cagayan Province (at the boundary with Apayao and Ilocos Norte Provinces; to the immediate NE of Adams; Figure 1), this species is recognized by its distinct advertisement call (Brown *et al.* 1999b; described as "Kree-eek...Kree-eek). Classified as "Endangered" (IUCN 2011) due to a previous assessment as a range-restricted species in an area where habitat degradation was known to be progressing, this species is now known

to be moderately widespread, commonly encountered, and locally extremely abundant at low to mid-elevation forested sites in western Cagayan, Apayao, and Ilocos Norte Provinces, including populations on Luzon and Palaui Islands (ACD and RMB, *personal observations*). This species occurs at high densities along forest edges, in secondary growth and marginal, disturbed habitat surrounding clearings and agricultural land. Given that this species now fails to qualify for the IUCN formal criteria (IUCN 2010) for belonging in one of the major threat categories, we consider this taxon to be "Near Threatened" (NT).

Locally most similar to *Platymantis* sp. 2 "See-yok" (below), this species shares with that taxon the characteristics of an extremely polymorphic dorsal color pattern, a preference for slightly raised perches at calling sites (stumps, shrub-layer vegetation, boulders, etc.), and its moderate body size (25–30 mm male SVL; 34–38 mm for females). To the best of our knowledge, the distinct mitochondrial genotype and the advertisement call are the most reliable diagnostic characters for determining the identity of *P. cagayanensis*. Figure 15. Location 2: KU 329594; Location 3: KU 329725; Location 4: KU 329595–620.

Figure 15. *Platymantis cagayanensis* (KU 329594) at Location 3. Photo by RMB.

Platymantis corrugatus (Duméril, 1853)

This common, widespread species is known throughout the Philippine archipelago (Alcala and Brown 1998b, 1999). Identified by its prominent black facial "mask" and its distinctive "quack...quack" advertisement call, this species exhibits peak calling activity right at sunset. Males call from leaf litter (often underneath dry leaves on the forest floor). This species' conservation status is classified as "Least Concern" (LC; IUCN 2010). Location 1: KU 329762–66.

Platymantis cornutus (Taylor, 1922)

Previously known in collections on the basis of a single specimen (The holotype: CAS 231501) collected in Kalinga Province (Taylor 1920, 1922a), we found this species to be widespead, common, and exceedingly abundant (given sufficient precipitation) at mid elevation sites in Ilocos Norte. Having previously hypothesized (and now confirmed) the identity of this species in Kalinga, Apayao, Aurora, and Cagayan Provinces (Brown *et al.* 2000a; Diesmos *et al.* 2005; Siler *et al.* 2010; Brown *et al.* unpublished data), we can now conclude that this species is widespread on Luzon along its eastern and western coastal mountain ranges. The species has previously been considered "Data Deficient," and was upgraded to "Vulnerable" in 2004 (IUCN 2010; B1ab(iii)) because of its presumably restricted (< 20,000 km^2) and "severely fragmented" distribution with the extent and quality of its habitat presumably declining in a small area of Luzon. However, it is quite clear that this species is now extremely widespread, commonly encountered, and locally abundant (if studied at the onset of the rainy season). *Platymantis cornutus* no longer qualifies for any of the formalized IUCN threatened criteria (IUCN 2010) justifying inclusion in any of the major threat categories; given that it does not qualify for any level of threat, but does in some way, appear to be reliant on forest habitats (with the qualifier that heavily disturbed and regenerating forests support many populations of this species), we consider it "Near Threatened" (NT). We do not anticipate that this species will qualify for "Vulnerable" (VU) in the near future.

Males were frequently heard at Locations 2–4, calling from the forest canopy, and elevated aerial ferns (Figure 16). Their advertisement calls can be identified by their rapid note repetition rate and high numbers of notes per call (Brown *et al.* 1999b). Clutches of direct-developing embryos (Figure 17) were collected from within aerial ferns at Locations 1 and 2. Like most species of Philippine *Platymantis*, *P. cornutus* is highly polymorphic in dorsal color pattern (*e.g.*, Figures 18, 19); at Location 1 we documented eight major dorsal color patterns in the same population. Figures 18, 19. Location 1: 329621–329647, 329649–64; Location 2: 329648, 329665–77.

Figure 16. Arial fern, typical preferred habitat (at Locations 1 and 2) of *Platymantis cornutus* and *Philautus surdus*. Photo by RMB.

Figure 17. Direct-developing embryos (KU 329621) of *Platymantis cornutus*, collected from aerial ferns (Figure 16) at Location 1. Photo by RMB.

FIGURE 18. One of several predominant polymorphic color patterns of male *Platymantis cornutus* (KU 329624) at Location 1. Photo by RMB.

FIGURE 19. Dark color morph of *Platymantis cornutus* (male KU 329625) at Location 1. Photo by RMB.

Platymantis polillensis (Taylor, 1922)

In the mountains of the northern Cordillera, *Platymantis polillensis* occurs in shrubby vegetation of secondary-growth forests and is commonly encountered at the beginning of the rainy season on exposed ferns and saplings in forest gaps and along forest edges. This species was the most abundant frog encountered at most sites in mid-elevation forests of Adams; calling males appeared to concentrate on areas of moderate disturbance such as treefall gaps in the forest or at the forest edge bordering agricultural lands. *Platymantis polillensis* calls with a slow train of single notes, each consisting of rapidly stridulated pulses, and sounding to the human ear like high frequency chirps.

Previously considered "Critically Endangered," this species was downgraded recently to "Endangered" (IUCN 2011) with the discovery of a population on Luzon Island (Siler *et al.* 2010). It has retained "Endangered" (EN) status because its extent of occurrence was judged to be less than 5,000 km^2, its distribution was thought to be severely fragmented, and an assumption of continuing decline in the extent and quality of forests on Polillo and Luzon. Now known from Polillo Island, and Quezon, Camarines Norte, Bulacan, Aurora, Ilocos Norte and Cagayan Provinces of Luzon Island (RMB and ACD unpublished data; Siler *et al.* 2011a; McLeod *et al.,* 2011), it is quite clear that this species is widespread, commonly encountered, and locally abundant throughout much of the Luzon faunal region. The conservation status of *P. polillensis* now must be substantially downgraded based on this new information. This taxon is now known to be a common component of both pristine and disturbed forests of low to mid-elevation herpetological communities throughout much of Luzon and is also clearly tolerant of forest disturbance, suggesting that it is not close to qualifying for IUCN threat level classification and is unlikely to do so in the foreseeable future. Because *P. polillensis* does not qualify for any of the formalized IUCN criteria (IUCN 2010), we consider this taxon to be "Near Threatened" (NT). Our hesitancy in not considering this species "Least Concern" (LC) stems from the fact that it appears to specialize in regenerating and disturbed vegetation (shrubs, ferns, young saplings) in forest gaps and along forest edges and so, to some degree, is reliant on some form of vegetation cover. However, we find no way to continue justification for this species as "Vulnerable" (VU) and we do not see how it could qualify for this (or any other) threat category in the near future (IUCN 2010). The Polillo Island (type locality) population may warrant special consideration. It does appear to be restricted to a few sites, where local populations of this species possibly is in decline. Consideration of the local (*i.e.*, Polillo Iland) population conservation status of this species is an issue that should be addressed by the local government units with jurisdiction over Polillo. From a national (or global) perspective, however, this species clearly is not threatened with extinction. Figure 20. Location 1: KU 329978–101; Location 2: KU 330002–10; Location 4: KU 330011–19; Location 19: PNM 8633.

FIGURE 20. Typical appearance of male *Platymantis polillensis* (KU 330003) at Location 1. Photo by RMB.

Platymantis pygmaeus Alcala, Brown, and Diesmos, 1998

First discovered in Palanan, Isabela Province, *Platymantis pygmaeus* is now known to be widespread and abundant in Bulacan, Quezon, Aurora, Isabela, Cagayan Ilocos Norte and Kalinga Provinces (Alcala *et al.* 1998; Brown 2000b; Siler 2010). We observed this species calling from low perches (30–60 cm from the ground) on herb layer vegetation; with its brief "click...click...click" advertisement call, this species is extremely difficult to locate in forests, which may contribute to it being relatively rare in collections (and considered not abundant by conservation status assessors). Originally classified as "Vulnerable," the justification for this threat category may no longer be tenable (IUCN 2011); we consider downgrading the conservation status of the species to

"Near Threatened" (NT) advisable, given that the original justification (B1ab(iii)) relied on the assumption that it was reliant on forests, inhabited a "severely fragmented" and restricted range, and should then be negatively impacted by habitat degradation at the few sites it was then considered to occupy. As field survey data have accumulated, this species has emerged as a much more commonly encountered, locally abundant taxon, that is now frequently recorded at many widespread sites throughout Luzon. We hesitate to downgrade its status to "Least Concern" (LC) because we acknowledge that the species—although tolerant of disturbance and frequently encountered in regenerating forests—appears to be restricted to areas with some form of vegetation cover. Figure 21. Location 1: KU 329756–57; Location 2: KU 329758–60; 329761.

FIGURE 21. *Platymantis pygmaeus* (male KU 329761) at Location 6. Photo by RMB.

Platymantis sp. 1 "Shek-shek"

First observed in Old Balbalan Town (Kalinga Province) in 1998 (Brown and Diesmos unpublished data), this unidentified species was locally abundant at Location 1 (~730 m) but not at lower or higher elevations. We suspect that this presumably undescribed species may be elevationally restricted; at present it has only been recorded at two mid-elevation sites in Kalinga and Ilocos Norte Provinces. Figure 22. Location 1: KU 329712–24, 329726–51.

FIGURE 22. *Platymantis* sp. 1 ("Shek-shek;" KU 329760) at Location 1. Photo by RMB.

Platymantis sp. 2 "See-yok"

Also first observed in Old Balbalan Town (Kalinga Province) in 1998 (Brown and Diesmos unpublished data), this potentially new and apparently undescribed species has been recorded at dozens of sites throughout most of central and northern Luzon. Morphologically most similar to *P. cagayanensis*, this species can only be reliably identified (to date) by its distinct mitochondrial genotype and distinctive advertisement call (Brown *et al.* unpublished data). Figures 23–25. Location 1: KU 329952–60; Location 2: 329961; Location 3: 329962–77.

FIGURE 22. One predominant color pattern of male *Platymantis* sp. 2 ("See-yok;" KU 329959) at Location 1. Photo by RMB.

FIGURE 23. Another common color morph of male *Platymantis* sp. 2 ("See-yok;" KU 329958) at Location 1. Photo by RMB.

FIGURE 25. Appearance of female *Platymantis* sp. 2 ("See-yok;" KU 329968) at Location 4. Photo by RMB.

DICROGLOSSIDAE

Fejervarya moodiei (Taylor, 1920)

This widespread endemic species is an estuarine specialist that can be found in a coastal habitats and brackish water swamps. Previously considered conspecific with the widespread *F. cancrivora*, new genetic evidence indicates that Philippine populations are morphologically and genetically distinct; the available name for the Philippine population is *Fejervarya moodiei* (Kurniawan *et al.* 2010, 2011). Widespread and common at most coastal areas throughout the country, this species is considered "Least Concern" (LC; IUCN, 2011). Location 15: PNM 6216; Location 16: PNM 5559–5575.

Fejervarya vittigera (Wiegmann, 1834)

Common in heavily disturbed areas and land cleared for agriculture, this Philippine endemic is widespread throughout the country and is most often encountered in flooded rice fields. Our specimens were collected in rice fields on the outskirts of Adams, Ilocos Norte and were first identified by their loud "honking" advertisement call. A large series was collected in agricultural areas in the Municipality of Vintar (Location 10). This species' conservation status is classified as "Least Concern" (LC; IUCN 2010). Figure 26. Location 3: KU 329571–73; Location 10: USNM 229625–27, 305219–343, CM 116077–82; Locations 11–14: Specimens deposited in PNM; Location 16: PNM 5558; "Ilocos Norte Province:" PNM 6186–6190.

FIGURE 26. Male *Fejervarya vittigera* (KU 329573) at Location 3. Photo by RMB.

Hoplobatrachus rugulosus (Wiegmann, 1834)

This introduced invasive species (Diesmos *et al.* 2006) was first detected in Laguna Province in the late 1990s (ACD unpublished data) and has continued to spread throughout the archipelago, including the northern most reaches of Luzon. We encountered this species in high abundance in the heavily disturbed agricultural fields on the outskirts of Laoag City. This invasive species' conservation status is classified as "Least Concern" (LC; IUCN 2010). Locations 11–14: Specimens deposited in PNM.

Limnonectes macrocephalus (Inger, 1954)

This large bodied, semi-aquatic fanged frog is one of the most widespread, commonly encountered and locally abundant species of Luzon endemics and is found in virtually all riparian habitats in primary, secondary, and even in degraded forest. We observed this species on stream- and riverside rocks, in mid-stream on boulders and snags, and on mud and gravel riverbanks. Categorized as "Near Threatened" principally because it is targeted by humans for food (and, thus, may qualify for an IUCN threat category in the future), this species remains one of the most widespread and common species on Luzon, with no evidence of population declines yet recorded. Figure 27. Location 1: KU 330136–60; Location 2: KU 330161–63; Location 4: KU 330165–67; Location 17: PNM 5697–5700; Location 19: PNM 5985.

FIGURE 27. Male *Limnonectes macrocephalus* (KU 330167) at Location 4. Photo by RMB.

Limnonectes cf. *woodworthi* (Taylor, 1923)

A second species of large bodied, semi-aquatic fanged frog has been recorded along the north coast of Luzon, on Palaui Island, and on Camiguin Norte Island (Oliveros *et al.* 2011). This northern Luzon population is phenotypically most similar to *L. woodworthi* but differs several slight distinguishing features. This species was observed (by RMB and ACD) in the year 2000 on Palaui Island and along the boundary between Ilocos Norte and NW Cagayan Province (Santa Praxedes area). Males were observed calling from road-side drainage ditches along the north coastal road near the town of Santa Praxedes (RMB and ACD personal observation). This species' conservation status is classified as "Least Concern" (LC; IUCN 2010). Location 8: No specimens; Location 19: PNM 7523.

Occidozyga laevis (Günther, 1859)

This species of puddle frog is widespread throughout the islands of Southeast Asia and can be found in a variety of riparian habitats throughout the Philippines. Our specimens were collected in small side pools of forested streams. This species is classified as "Least Concern" (LC; IUCN 2010). Location 1: KU 329574–82; Location 2: KU 329583–84, 329594; Location 3: KU 329585–93, 329595–620; Location 7: CAS-SU 3279; Location 19: PNM 5233–5235.

MICROHYLIDAE

Kaloula kalingensis Taylor, 1922

We collected this species from water-filled holes in trees (30–100 trunk diameter; holes 1–4 m above the ground) in low to mid-elevation forested areas. Recent

molecular data suggest *K. kalingensis* is most likely a complex of distinct evolutionary lineages, probably deserving of species rank (Brown *et al*. unpublished data). As our specimens were collected near the type locality (Kalinga Province), we anticipate that this population represents true *K. kalingensis*. This species is classified as "Vulnerable" (B1ab(iii)) due to the fact that it relies on forests (specifically, water-filled tree holes) for reproduction, its range was assumed to be "severely fragmented," and forest cover is presumed to be declining at many sites throughout Luzon. However, we note that the species inhabits a wide geographical range, is ubiquitously encountered in surveys of forested sites, and appears to do quite well in secondary forests, provided that any form of standing tree cover (even invasive bamboo is sufficient; RMB personal observation) remains to provide sites for egg deposition. We see no compelling justification for inclusion of this taxon in any level of threat category, but we provisionally consider it "Near Threatened" because we recognize that its reliance on some form of vegetation cover for reproduction brings it close to qualifying for "Vulnerable" (VU). However, we note that if the IUCN takes steps to recognize the distinction between forest types as a factor worthy of consideration conservation status assessments, this species may need to be downgraded further to "Least Concern." Figure 28. Location 1: KU 329554–329563; Location 2: KU 329564; Location 3: 329565–70.

Figure 28. Male *Kaloula kalingensis* (KU 329557) from Location 1. Photo by RMB.

Kaloula picta (Duméril and Bibron, 1841)

A large series of this widespread Philippine endemic was collected at Location 10 in disturbed forests and agricultural fields. This species is classified as "Least Concern" (LC; IUCN 2010). Location 10: USNM 229624, 305018–305217, CM 116181–89; Locations 11–14: Specimens deposited in PNM; Location 16: PNM 6679–6684; Location 17: PNM 6685–6688; Location 18: PNM 6689; "Ilocos Norte Province:" PNM 6671–6675.

Kaloula pulchra Gray, 1825

This introduced invasive species (Diesmos *et al.* 2006) is becoming widely distributed on Luzon and several other islands; as faunal inventories accumulate *K. pulchra* is emerging as a commonly encountered component of herpetofaunas in low elevation, disturbed habitats, suggesting that its impact on native species may be increasing. We encountered this species in riparian habitats (heavily impacted streams near residential areas) in disturbed agricultural fields on the outskirts of Laoag City. This invasive species is classified as "Least Concern" (LC; IUCN 2010). Locations 11–14: Specimens deposited in PNM.

Kaloula rigida Taylor 1922

Originally described from Baguio City, Benguet Province, this fossorial, ephemeral pool-breeding specialist has now been recorded at numerous sites to the south and east of Adams (Kalinga, Apayao, Ifugao, and Benguet Provinces of the Cordillera and Isabela and Cagayan Provinces of the northern Sierra Madre). *Kaloula rigida* was recorded on the boundary between Ilocos Norte and NW Cagayan Province near the town of Santa Praxedes. Males were observed calling from flooded road-side drainage ditches along the north coastal road (RMB and ACD personal observation).

Considered "Vulnerable" (B1ab(iii)) (IUCN 2011) because its presumably restricted extent of occurrence was considered "severely fragmented," and continued decline in the extent and quality of Luzon's forest was assumed, we now know that this species is much more widely distributed than originally assumed and does not rely on intact forests for reproduction. *Kaloula rigida* is now known to occur at high abundances in disturbed habitats at many sites, provided that surveys are undertaken at the beginning of the rainy season following heavy rains, when individuals emerge from the ground to breed. Our application of the IUCN criteria leads us to the conclusion that because this species appears associated with at least some forest cover, it is best considered "Near Threatened" (NT) but that no longer qualifies for one of the higher, formal threat categories (IUCN 2011). Figure 29. Location 8: KU 328628; Location 19: Specimen in PNM.

Figure 29. Male *Kaloula rigida* (KU 328628) from Location 8. Photo by RMB.

Ranidae

Hylarana similis (Günther, 1873)

We encountered this widespread, locally abundant Luzon endemic in all riparian habitats sampled. Specimens were observed along stream banks and on rocks mid-stream; this species is known from throughout the Luzon Pleistocene Aggregate Island complex, including Luzon, Palaui, Catanduanes, Marinduque, and Polillo islands (Brown and Guttman 2002) and it is highly tolerant of disturbance. This species has a range greater than 20,000 km^2, and there is no evidence that it is intolerant of the

loss of extent of quality of its habitat. Thus, we find that it does not qualify for "Vulnerable" (VU). We hesitate to down grade it to "Least Concern" (LC), however, because recent evidence suggests that this species has been infected with *Batrachochytrium dendrobatidis* (Bd; Swei *et al.* 2011) at at least one site (no evidence of population decline is yet available). As a compromise, we consider this species "Near Threatened" (NT). Figure 30. Location 1: KU 329776– 815; Location 2: KU 329816; Location 3: KU 329817–23. Location 10: USNM 498505–06.

FIGURE 30. Female specimen of *Hylarana similis* (KU 329815) from Location 4. Photo by RMB.

Sanguirana igorota (Taylor,1922)

This species of wide-disked cascade stream frog was encountered at Locations 1 and 2. This species has also been encountered in the central Cordillera (Kalinga and Apayao Provinces; Diesmos *et al.* 2005; specimens in FMNH), and on Mt. Palali, Carabao Mountains, Nueva Viscaya Province (specimens in KU), in Kabayan, Benguet Province, and Banaue, Ifugao Province (specimens in PNM). This species prefers extremely high-gradient, rapidly cascading streams with large boulders (Figure 10) or steep banks—a microhabitat preference that distinguishes it from sympatric congeners *Sanguirana luzonensis* and *S. aurantipunctata* but not *S. tipanan* (Brown *et al.* 2000a, b; Fuiten *et al.* 2010). We propose to downgrade this species from "Vulnerable" (VU) to "Near Threatened" (NT) because although its extent of occurrence is less than 20,000 km^2, our data suggest that the species is widely distributed, and occurs naturally at mid- to high-elevation sites at many forested sites. This area of occurrence is "fragmented," because high elevation forests are, naturally, non-continuous (divided by lowlands); however we fail to see how this range could be interpreted as "severely fragmented" by the activities of humans. Given low commercial value of high elevation forests, we do not anticipate substantive decline in extent of quality of forests, except at sites where agriculture has pushed to the highest elevations (*e.g.*, Mt. Data area). We retain the "Near Threatened" (NT) category, however, because we recognize that this species is reliant on high gradient streams in (naturally) small patches of forested habitat because we anticipate that continued clearing of the Cordillera's high elevation forests will occur as a result of extensive vegetable plantations concentrated in this region. Figures 31, 32. Location 1: KU 329824–72; Location 2: KU 329873–88; Location 3: KU 329889.

FIGURE 31. Typical female *Sanguirana igorota* in life (KU 329860; Location 1). Photo by RMB.

FIGURE 32. Typical appearance of male *Sanguirana igorota* in life (KU 329859; Location 1). Photo by RMB.

Sanguirana luzonensis (Boulenger, 1896)

We encountered this common, widespread Luzon island group endemic in slow moving streams and rivers at Locations 2 and 4. Specimens were observed along stream banks on rocks and in low, over-hanging vegetation. *Sanguirana luzonensis*'s wide tolerance for a variety of habitats distinguishes it from all other Luzon members of the genus (*S. igorota, S. tipanan,* and *S. aurantipunctata*). Considered "Near Threatened," original assessments were based on the assumption that the extent of its occurrence was less than 5,000 km^2, which is clearly incorrect, given that it occurs throughout the Luzon faunal region, including the islands of Luzon, Catanduañes, Polillo, Marinduque, Palaui, and many other small landmasses, with an elevation range between sea level and 1,500 m. Given no evidence for decline in habitat, reliance on any one habitat type, or reduced extent of occurrence, this species is considered by us to be "Least Concern" (LC). Figure 33. Location 1: KU 329696–98; Location 2: KU 329699; Location 3: KU 329700–04; Location 10: USNM 229637, 305218.

RHACOPHORIDAE

Philautus surdus Peters, 1863

This somewhat infrequently encountered species exhibits a widespread distribution throughout the Luzon Island group and possibly other regions of the Philippines. We encountered many individuals on shrub layer vegetation and understory trees, usually perched on leaves where males call with distinctive "crunch" vocalizations. This species is considered "Least Concern" (LC) (IUCN

2010). Figure 34. Location 1: KU 329890–23; Location 2: KU 329924–28.

FIGURE 33. *Sanguirana luzonensis* pale morph (KU 329706) from Location 1. Photo by RMB.

FIGURE 34. Male *Philautus surdus* (KU 329909) from Location 1. Photo by RMB.

Polypedates leucomystax Gravenhorst, 1829

Frogs referred to this species are part of a complex of potentially distinct lineages distributed throughout Southeast Asia (Brown *et al.* 2010b). Although endemic to the archipelago, the *P. leucomystax* genetic variant in the Philippines appears to be genetically identical throughout its range, possibly as a result of habitat conversion and human mediated dispersal throughout the country. This species is known from dry, coastal areas near agriculture, all the way to 1000+ m high in the Northern Cordillera where it has been found in pristine forests at high elevation (Diesmos *et al.* 2005; 2006). This widespread species is considered "Least Concern" (LC) (IUCN 2010). Figure 35. Location 4: KU 329752–55; Location 10: USNM 229628–30; Locations 11–14: Specimens deposited in PNM; Location 18: PNM 3807–3808.

Rhacophorus pardalis Günther, 1859

This morphologically variable gliding tree frog is found throughout the country and neighboring Southeast Asia (Brown and Alcala, 1994; Alcala and Brown, 1998b). Our specimens were collected from the branches of saplings surrounding stagnant pools next to a small stream in forests between 700 and 1100 m. This widespread species is considered "Least Concern" (LC) (IUCN 2010). Figure 36. Location 2: KU 329767–71; Location 3: KU 329772–75; Location 19: Specimens in PNM.

FIGURE 35. Male *Polypedates leucomystax* (KU 329752) from Location 3. Photo by RMB.

FIGURE 36. Male *Rhacophorus pardalis* (KU 329771) from Location 3. Photo by RMB

REPTILIA (Lizards)

AGAMIDAE

Bronchocela marmorata Gray, 1845

We found this species asleep at night on branches of trees and shrubs in disturbed habitats bordering agricultural lands (Figure 14). Although our specimens clearly coincide with the definition of *B. marmorata* (Taylor 1922a; Hallermann 2005) we hesitate to conclude that this species co-occurs on Luzon with *B. cristatella*, given the slight character differences that distinguish the two forms and the lack of genetic data suggesting the existence of two species on Luzon (Brown, Siler, Welton, Diesmos, and McGuire unpublished data; Mcleod *et al.*, 2011). Individuals were spotted from below, 4–6 m above the ground in second growth trees and agricultural hedgerows. The conservation status of this widespread, disturbance-tolerant species is "Least Concern" (LC). Location 4: KU 329535–38.

Draco spilopterus (Wiegmann, 1834)

We observed this species on multiple occasions in forests on Mt. Pao between 300 and 800 m. Local residents report them to be uncommon in the town center of Adams where coconut palms (the preferred microhabitat for this species; McGuire and Alcala 2000) are present. Our few specimens came from dense forests and were encountered 2–4 m from the ground in sunspots in the mid- to late morning. The conservation status of this widespread,

disturbance-tolerant species is "Least Concern" (LC). Location 3: KU 329524; Location 5: CAS 60965–66; Location 15: PNM 1071.

GEKKONIDAE

Cyrtodactylus philippinicus (Steindacher, 1867)

This common forest gekkonid was collected on tree trunks, downed logs, and root masses over hanging small mountain streams between 300 and 800 m. The conservation status of this widespread, disturbance-tolerant species is "Least Concern" (LC). Figure 37. Location 1: KU 329530–33; Location 4: KU 329534; Location 5: USNM 66795.

FIGURE 37. Male *Cyrtodactylus philippinicus* (KU 329531) at Location 1. Photo by RMB

Gehyra mutilata (Wiegmann, 1834)

We observed this species on the walls of buildings in the town center of Adams, in Laoag City, and many other localities; *G. mutilata* was only observed in dark areas, on walls away from lights. The conservation status of this human commensal species is "Least Concern" (LC). Location 3: No specimens collected; Location 17: Specimen in PNM.

Gekko gecko Linnaeus, 1758

The conservation status of this common human commensual species is "Least Concern" (LC). Location 17: PNM 5896–5897; Location 20: PNM 5907.

Hemidactylus frenatus Duméril and Bibron, 1836

We observed this species on the walls of buildings in the town center of Adams under external electric lights. The conservation status of this human commensal species is "Least Concern" (LC). Location 3: No specimens collected; Location 5: USNM 66794.

Lepidodactylus lugubris (Duméril and Bibron, 1836)

A single uncatalogued specimen has been deposited in PNM. The conservation status of this common species is "Least Concern" (LC). Location 19: Specimen in PNM.

SCINCIDAE

Brachymeles bonitae Duméril and Bibron, 1839

We collected individuals of this species under rotting logs and loose forest detritus surrounding tree roots and buttresses in low to mid-elevation secondary-growth forests. This species has a wide geographic distribution, occurring on Camiguin Norte, Lubang, Luzon, Marinduque, Masbate, Polillo, Sibuyan, and Tablas islands (Siler and Brown 2010). The conservation status of this species is best considered "Data Defficient" (DD), pending ongoing studies of its taxonomy and geographical range (Siler *et al*. unpublished data). Figure 38. Location 1: KU 329539; Location 3: KU 329540–53.

FIGURE 38. Male *Brachymeles bonitae* (KU 329543) from Location 4. Photo by RMB.

Eutropis multicarinata borealis Brown and Alcala, 1980

Several specimens were collected along river banks at Locations 1 and 3. This active subspecies basks in open sun and is extremely difficult to capture, despite being frequently observed (RMB personal observation). The conservation status of this widespread habitat generalist is "Least Concern" (LC). Location 4: KU 329521–23.

Eutropis multifasciata (Kuhl, 1820)

We observed this species on edges of agricultural land surrounding Adams. *Eutropis multifasciata* is active in open sun and was observed on several occasions retreating into nearby shrubs following disturbance by collectors. The conservation status of this widespread habitat generalist is "Least Concern" (LC). Locations 3, 4: No specimens collected; Location 6: CAS 60967–68.

Lamprolepis smaragdina philippinica Mertens, 1829

Collected from coconut palms in the town center of Adams, this subspecies is a widespread human commensal with a distinctive color pattern that is recognized as an endemic Philippine subspecies (Brown and Alcala, 1970a, 1980; Linkem *et al*., in press). The conservation status of this exceptionally widespread coastal area specialist species is "Least Concern" (LC). Location 3: KU 329518–19; Location 15: Specimen in PNM.

Lipinia pulchella levitoni Brown and Alcala, 1980

We found only a single specimen of this subspecies on an understory sapling trunk at 730 m in a secondary and selectively logged primary forest. So infrequently encountered, with no evidence for habitat restriction or reduced extent of occurrence, the conservation status of this species is "Data Defficient" (DD). Location 1: KU 329525.

Pinoyscincus abdictus aquilonius (Brown and Alcala, 1980)

This common, widespread subspecies is active on forest edges and in sun spots and canopy gaps in original and second growth forests (Brown and Alcala 1980; Brown *et al.* 2000b; Linkem *et al*. 2010). We observed individuals

at low and mid-elevation sites on Mt. Pao but not in Adams town proper. Although the extent of occurrence for this common widespread species may be less than 20,000 km^2, it fails to qualify for any level of threat; thus, the conservation status of this widespread habitat generalist is "Least Concern" (LC). Location 1: KU 329526–28; Location 4: KU 329529.

Parvoscincus decipiens (Boulenger, 1895)

This forest species is active in leaf litter and along small streams in well-regenerated second growth and primary forests at low and mid-elevation sites. We collected specimens by hand along small streams and seeps and in pitfall traps placed away from streams along fallen tree trunks and decayed logs. Although widely distributed throughout the Luzon faunal region and occurring in a wide variety of low to high-elevation habitats with varying levels of disturbance, this species does appear to be restricted to habitats with some form of vegetation cover. Given that it is close to qualifying for "Vulnerable" (VU; IUCN 2011), we consider it "Near Threatened" (NT). Figure 39. Location 1: KU 329929–30; Location 2: KU 329931; Location 4: KU: 329932–51.

Figure 39. Male *Parvoscincus decipiens* (KU 329939) from Location 4. Photo by RMB.

Parvoscincus leucospilos (Peters, 1872)

This rare, semiaquatic Luzon forest species was known from only two specimens with no known provenance (Brown and Alcala, 1980) until it was rediscovered in Aurora Province (Brown, 2000a; Siler *et al.*, 2011a) and again in Bulacan Province (McLeod *et al.*, 2011). This species prefers secluded microhabitats (under debris, leaf litter, small rocks) less than a meter from rapidly running moutain streams, and has been found wedged into rock crevices in water logged rock faces and waterfalls (RMB, *personal observations*). This species is behaviorally unique among Philippine lizards in that, when disturbed, it attempts to escape predation by diving into water. Location 1: KU 329929.

Parvoscincus steerei (Stejneger, 1908)

This common, widespread Philippine endemic has been documented throughout the archipelago (Brown and Alcala 1980). On Luzon, it is frequently encountered in a variety of forest types, given sufficient vegetation cover (Brown and Alcala 1980; Brown *et al.* 1996, 2000a; Siler *et al.* 2010). Although uncommon in this part of northern Luzon, we obtained two specimens under rotten logs at Location 1. This species is very frequently encountered and can be found in heavily disturbed habitats, but it qualifies for "Near Threatened" (NT) for the same reasons as does *P. decipiens*. Location 4: KU 329520.

Varanidae

Varanus marmoratus (Wiegmann, 1834)

This Luzon Island group endemic species is widespread and most common at low elevation sites, coastal areas, around agricultural areas, and surrounding human settlements (Gaulke 1991a, b; 1992). Specimens were collected at forested sites between 300 and 750 m on Mt. Pao. Although not qualifying for any level of direct threat, this species is heavily hunted for food, pet trade, and leather. However, we note that this species is widely distributed throughout the Luzon faunal region, including many islands, and that it thrives in a wide variety of habitats, especially those modified by the activities of humans. This widespread human commensal species is considered "Least Concern" (LC; IUCN 2010). Figure 40. Location 1: KU 330132; Location 4: KU 330133; Location 10: USNM 305361, CM 116066.

Figure 40. Adult male *Varanus marmoratus* (KU 330132) from Location 1. Photo by RMB.

REPTILIA (Snakes)

Acrochordidae

Acrochordus granulatus Schneider (1799)

A single specimen of this widespread, fully aquatic estuarine species was collected off the coast of Cabugao, near the boundary with Ilocos Sur Province. The extent of occurrence of this species is unknown in the Philippines but it is widely distributed throughout Southeast Asia; although coastal habitats in the Philippines are heavily impacted (and suitable habitats in the country have been reduced), this species' wide extent of occurrence does not qualify it for classification at any level of immediate threat ("Least Concern," LC; IUCN 2010). Location 9: USNM 39936.

Colubridae

Ahaetulla prasina preocularis (Taylor, 1922)

We collected specimens of this vine snake as they slept on branches of saplings and understory vegetation

in secondary-growth and selectively logged first growth forests. This subspecies is widely distributed throughout the Philippines (Leviton 1967). The conservation status of this widespread habitat generalist species is "Least Concern" (LC; IUCN 2010). Figure 41. Location 1: KU 329696–98; Location 2: KU 329699; Location 4: KU 329700–04; Location 17: PNM 257.

FIGURE 41. *Ahaetulla prasina preocularis* (KU 329698) from Location 1. Photo by RMB.

Calamaria gervaisii Duméril, Bibron, and Duméril 1854

This small, semi-fossorial species is common throughout the Philippines (Inger and Marx, 1965) and is frequently encountered in disturbed areas, second growth forests, and primary forests. Our specimens were collected under rotten logs and bark. We categorize the conservation status of this widespread habitat generalist as "Least Concern" (LC). Figure 42. Location 3: KU 329684–85.

FIGURE 42. *Calamaria gervaisii* (KU 329684; Location 5). Photo by RMB.

Coelognathus erythrura manillensis Jan, 1863

One of four subspecies of this Philippine endemic, *C. e. manillensis* has been documented at various localities throughout Luzon (Leviton 1979; Helfenberger 2001). A single specimen of this subspecies was collected at Location 4 (375 m elevation) as it was actively foraging at night. We define *C. e. manillensis* as "Data Defficient (DD) because the taxonomy and distribution of this taxon is poorly understood, and because its habitat requirements and extent of occurrence are unknown. Location 4: KU 330135.

Dendrelaphis luzonensis Leviton, 1961

This common, widespread semi-arboeal snake was collected in secondary-growth forests at Location 4. Both specimens were collected as they slept on shrubs adjacent to cleared agricultural land. We consider the conservation status of this widespread habitat generalist to be "Least Concern" (LC). Figure 43. Location 4: KU 329678–79; Location 10: USNM 229631, 305344–35; Location 15: PNM 442.

FIGURE 43. *Dendrelaphis luzonensis* (KU 329678) from Location 4. Photo by RMB.

Dendrelaphis marenae Vogel and Van Rooijen, 2008

This common, widespread Philippine endemic was captured in shrubs in an agricultural area near Barangay Pansian, Municipality of Pagudpud. The conservation status of this widespread habitat generalist to be "Least Concern" (LC). Location 19: PNM 487.

Gonyosoma oxycephalum (Boie, 1827)

A single specimen was collected from a tree on a small river bank at Barangay Paayas, Municipality of Burgos. The conservation status of this widespread nonendemic generalist species is "Least Concern" (LC). Location 17: Specimen in PNM.

Lycodon capucinus (Boie, 1827)

A single specimen was collected from agricultural areas surrounding Danao Barrio, NE of Vintar City. We consider the conservation status of this widespread habitat generalist to be "Least Concern" (LC). Location 10: USNM 305347.

Psammodynastes pulverulentus (Boie, 1827)

This widespread Southeast Asian "mock" viper is commonly collected on the ground (adult specimens) or in low vegetation (juveniles) in secondary and first-growth forests. Our specimens were collected as they actively foraged at night along stream banks at higher elevations on Mt. Pao. We consider the conservation status of this widespread habitat generalist to be "Least Concern" (LC). Figure 44. Location 1: KU 329687–89; Location 2: KU 329690; Location 15: Specimen in PNM; Location 17: Specimen in PNM.

Ptyas luzonensis (Günther, 1873)

This large bodied semi-arboreal ratsnake is frequently encountered while active during the day or sleeping in trees at night; it is known from throughout the northern

and central Philippines (Ross and Sison 1987). Our specimen was found asleep in a sapling on the edge of a small stream. Although widely distributed throughout the Luzon and Visayas faunal regions and occuring in a wide variety of low to high-elevation habitats with varying levels of disturbance, this species does appear to be restricted to forest habitats, including second growth vegetation. Given that it is close to qualifying for "Vulnerable" (VU; on the basis of habitat fragmentation and likely decline in habitat quantity; IUCN 2010), we consider it "Near Threatened" (NT). Location 1: KU 330134.

Figure 44. *Psammodynastex pulverulentus* (KU 329687) from Location 2. Photo by RMB.

Rhabdophis spilogaster (Boie, 1827)

This natricid is commonly recorded at low elevation areas and coastal regions throughout the archipelago (Malnate and Underwood 1988). We collected specimens on the edges of agricultural land on the outskirts of Adams town proper. The conservation status of this widespread species is "Least Concern" (LC; IUCN 2010). Figure 45. Location 3: KU 329682–83.

Figure 45. *Rhabdophis spilogaster* (KU 329682) from Location 3. Photo by RMB.

Elapidae

Naja philippinensis Taylor, 1922

A single Philippine cobra was collected from agricultural areas at Danao Barrio, 18 km NE of Vintar City. Although this species is widely distributed throughout disturbed and forested low elevation habitats of the Luzon, Mindoro, and Visayan faunal regions (including many dozens of islands), it is persistently persecuted by humans, suggesting that population size may be in decline. We thus consider it "Near Threatened" (NT; see also: IUCN 2010). Location 10: USNM 292492.

Lamprophiidae

Oxyrhabdium leporinum leporinum (Günther, 1858)

Oxyrhabdium is one of only four endemic genera of Philippine snakes. The subspecies *O. l. leporinum* is endemic to the Luzon Island group (Leviton 1964c) and is frequently encountered in riparian habitats under logs, rocks, and other cover. Our single specimen was collected at mid elevation on the bank of a small stream where it was actie at night. The conservation status of this species is "Least Concern" (LC; IUCN 2010). Figure 46. Location 1: KU 329691.

Figure 46. *Oxyrhabdium leporinum leporinum* (KU 329691) from Location 2. Photo by RMB.

Pythonidae

Broghammerus reticulatus Schneider 1801

Reticulated pythons are common in and around human settlements of Luzon (Brown *et al.* 1996; 2000a; Siler *et al.* 2010). Residents of Adams related numerous instances of sightings and interactions with "sawa" (python) in the context of agricultural settlements and predation on livestock (chickens, goats, and pigs) near town. We find these reports sufficiently credible to include this species in the present report. The conservation status of this species is "Least Concern" (LC). Location 3: No specimens; Location 15: Specimen in PNM.

Typhlopidae

Ramphotyphlops braminus (Daudin, 1803)

We collected this introduced parthenogenetic species under fallen logs in disturbed secondary-growth forests. The conservation status of this species is "Least Concern" (LC). Figure 47. Location 4: KU 329680–81; Location 20: Specimen in PNM.

Viperidae

Trimeresurus flavomaculatus (Gray, 1842)

We collected individuals of this pit viper perched on branches of trees in secondary growth forests at night in riparian habitats. Frequently encountered hunting

frogs at night on the banks of streams, ponds, and rivers, *T. flavomaculatus* is a sit-and-wait predator that can predictably be found near water in forested areas. This species occurs throughout Luzon (Leviton 1964a) and consists of numerous distinct color morphs (Siler *et al.* 2010). This widely distributed, commonly encountered species occurs in habitats with varying levels of disturbance and no evidence of fragmentation in extent of occurrence. We consider it "Least Concern" (LC). Figures 47. Location 1: KU 329692–93; Location 4: KU 329694–95.

FIGURE 47. *Ramphotyphlops braminus* (KU 329680) from Location 4. Photo by RMB.

FIGURE 48. Brick-red color morph of *Trimeresurus flavomaculatus* (KU 329693) from Location 1. See Siler *et al.* (2011a) for color photographs of addition Luzon color variants. Photo by RMB.

REPTILIA (Turtles)

BATAGURIDAE

Cuora amboinensis (Daudin, 1802)

Specimens from Danao Barrio, NE of Vintar City were collected from streams surrounding disturbed second growth and agricultural clearings. Although this species is distributed throughout the country and surrounding parts of Southeast Asia, it is heavily hunted for food, curiosities, pet trade, and traditional medicine. We consider *C. amboinensis* "Vulnerable" (VU: A1d+2d; see also IUCN 2010). Location 10: USNM 229632–36; 305349–60, CM 116200–01; Location 20: Two specimens in PNM.

Does the northern Cordillera Mountain Range possess an endemic herpetofauna, distinct from the amphibian and reptile communities of the northern Sierra Madre Mountains (Figure 1)? This expectation has been eluded to but not specifically addressed in numerous taxonomic works (Alcala *et al.* 1998; R. Brown *et al.* 1999; 2000b; 2007; W. Brown *et al.* 1997a, b, c; 1999b; Diesmos 1998; Diesmos *et al.* 2005; Wallach *et al.* 2007; Siler *et al.* 2009; Siler and Brown 2010; Fuiten *et al.* 2011) and a variety of faunal studies (Brown *et al.* 1996; 2000a; Diesmos *et al.* 2005; Siler *et al.* 2011). The results of this study suggest that the northern extremes of these two geologically distinct mountain ranges possess more species in common than previously believed. Thus, species that were previously considered Cordillera endemics (*e.g.*, *Platymantis cornutus, Kaloula kalingensis, K. rigida, Sanguirana igorota*) have been shown to be present in eastern Luzon (Siler *et al.* 2011; Fuiten *et al.* 2011; Brown *et al.* unpublished data), and notable and previously assumed Sierra Madre endemics are now known from the Cordilleras (*e.g.*, *Platymantis cagayanensis, P. polillensis, P. pygmaeus*).

The results of this study highlight the degree to which incomplete knowledge of species distribution and abundance patterns has negatively impacted conservation status assessments (IUCN 2010) and resulting priority setting exercises (*e.g.*, Alcala and Custodio 1995; Diesmos *et al.*, 2002; IUCN 2010). Our data definitively demonstrate that a number of of Luzon-endemic (*Kaloula kalingensis, K. rigida, Platymantis cagayanensis, P. cornutus, P. polillensis, P. pygmaeus, Sanguirana igorota, S. luzonensis, Hylarana similis*) with conservation status assessments ranging from "Vulnerable" to "Endangered" are actually widespread, common, locally abundant, and clearly not range-restricted microendemics. Future studies, based on field data from natural populations (and not from forest cover or the inferred presence of disturbance) will be necessary to evaluate the question of whether populations of these species are declining. One seemingly self-evident point that still needs emphasizing is the methodological importance of conducting surveys for Philippine amphibians at the start of the rainy season (June–August), which is the observed period of optimal activity of most species. The arid and unpredictable atmospheric conditions of the remaining months of the year render conclusions derived from surveys during these times moot for the simple reason that negative data are uninformative for the purposes of determining species presence/absence. An additional concern bears on the classification of species with areas of occurrence judged to be "range-restricted," and/or fragmented (IUCN 2011). In an island archipelago, or any non-continuous habitat type (*i.e.,* high elevation forests, limestone forests, wetlands, or any other patchily-distributed habitat type), most if not all species distributions will necessarily be categorized as "range-restricted" or "fragmented." We question the formulaic conservation threat categorization on the basis of these criteria (IUCN 2011) in the context of an island archipelago where, just by the nature of the geographical template, most (if not all) non-declining and non-threatened species will qualify.

Nevertheless, and even aside from the obvious logical flaw in applying conservation criteria developed in a continental framework to taxa from island archipelagos, our data suggest that many amphibian taxa previously

considered at some level of threat of extinction, must now be considered no longer vulnerable (or at least not for the foreseeable future). An example of an extreme case is the presumably range-restricted, critically endangered Polillo Island forest frog, *Platymantis polillensis*. Previously considered at the literal brink of extinction (Diesmos *et al.* 2002; 2004), all available data now suggest that it is a widespread, common, locally abundant taxon on multiple islands, and that it is tolerant of substantial disturbance and without population-wide evidence of decline. Clearly the numerous cases we have documented here suggest that many sorely misinformed conservation status assessments, which now serve as the basis of national (DENR 1997; 1998) and international (IUCN 2010; 2011) conservation planning, need to be updated, are based on incomplete or negative data, and should be revised in favor of actual data, derived from natural populations (*i.e.*, not secondarily inferred from forest cover, degree of fragmentation, inferred size of area of occurrence, or perceived threats).

The data we have presented paint a picture of the Ilocos Norte herpetofauna that is still far from complete. In this study we recorded the presence of 58 species (compared to: 52 species from the Zambales Mountains [Brown *et al.* 1996], 51 species from Balbalan-Balbalasang National Park [Diesmos *et al.* 2005], 52 species from the Babuyan Island Group, north of Luzon [Oliveros *et al.* 2011], 58 species for Catañduanes Island [Ross and Gonzales, 1992] and 45 species from Maria Aurora National Park [Brown *et al.* 2000a], later increased to 85 species [Siler *et al.* 2011]). In an early study of Aurora Province, Brown *et al*. (2000a) demonstrated that their diversity estimate was far from complete using species accumulation curves that failed to asymptote during their brief 10-day survey. Not surprisingly, a decade later, Siler *et al.* (2010) nearly doubled that diversity estimate by visiting different drainages in the same park, focusing on different habitat types, and sampling a wider range of elevations with distinct herpetofaunal communities. Clearly, these lessons have taught us the importance of repeated visits, focusing on different times of the year, covering a range of different atmospheric conditions, and targeting different elevations and distinct habitat types. Because of the often patchy distribution of many amphibian and reptile species, no area can be considered "well known" herpetologically until exhaustively sampled with a varied, multi-effort approach (Brown, 1996; 2000a; Diesmos *et al*. 2005; Siler *et al.* 2011; Diesmos and Brown 2011).

A number of species were conspicuously absent during our brief survey of the mountains surrounding Adams; many are known from the central and southern Cordillera (Diesmos *et al.* 2005) or are common throughout Luzon in coastal land areas (Inger 1954; Leviton 1962; 1963a, b; 1964a, b; 1965a, b; 1967; 1970; Brown and Alcala 1974; 1980; Alcala and Brown 1998). We predict that these species will be recorded during future surveys in the northern Cordillera. These species include the amphibians *Rhacophorus appendiculatus, R. bimaculatus*, and possibly the introduced species *Lithobates catesbeiana* (Diesmos *et al.* 2006). Lizard species that we expect will eventually be recorded in Ilocos Norte include *Gonocephalus sophiae, Hydrosaurus pustulosus, Gekko mindorensis, Hemidactylus platyurus, Luperosaurus angliit, Brachymeles bicolor, B. boulengeri, B. kadwa, B. elerae, Dasia grisea, Emoia atrocostata, Eutropis cumingi, E. bontocensis, E. indeprensa, P. luzonensis, P. lawtoni,* and *P. igorotorum.* Snakes that we expect are residents in Ilocos Norte include *Boiga cynodon, B. philippina, B. angulata, B. dendrophila divergens, Calamaria bitorques, Chrysopelea paradisi, Hemibungarus calligaster calligaster, Ophiophagus hannah, Lycodon muelleri, L. solivagus, Pseudorhabdium oxycephalum, Rhabdophis barbouri, Tropidonophis dendrophiops, Hologerrhum philippinum, Tropidolaemus subannulatus,* and *Typhlops ruficaudus,* and *T. luzonensis.*

In a recent study, Welton *et al.* (in press) documented the presence of a frugivorous monitor lizard identified as *V. olivaceus* in Cavite Province, extreme southwestern Luzon (the first record of this species from western Luzon). We consider it entirely possible that the related, northern Luzon species *V. bitatawa* (Welton *et al.* 2010b) may be present in the forests of northwest Luzon. In the foothills of Mt. Pao (Municipality of Adams) we observed characteristic scratch marks on the trunks of several trees, suggesting that large bodied (based on spacing between claw marks) monitor lizards regularly climb trees in the vicinity. Whether these were signs of the common species *V. marmoratus* (which does occasionally climb trees; *personal observations*) or the primarily arboreal *V. bitatawa* is unclear. Residents and hunters we interviewed in the area spoke only of the common "biyawak" (*V. marmoratus*) and no accounts of a very large or brightly colored arboreal monitor (suggestive of *V. bitatawa*; Welton *et al.*, 2010b) were forthcoming. Finally we anticipate that the freshwater turtles *Pelochelys cantori* and the introduced species *Pelodiscus sinensis* and *Chrysemys picta* (Diesmos *et al*. 2008) may eventually be recorded in the province. Coastal areas (and potential habitats for sea snakes and marine turtles) may support additional species diversity.

Reaching the goal of a reasonably well-understood Luzon herpetofauna will require numerous additional studies, focused on many additional sites and habitats types throughout the island. We urge field researchers to document herpetological diversity from as many sites as possible, and as many times per year as possible, throughout the island. Paradoxically, many forested regions closest to the country's large major metropolitan areas and universities remain some of the least studied habitats (Diesmos, 1998; Diesmos and Brown 2011; McLeod *et al.* 2011; Devan-Song and Brown 2012). However, sites that have been properly surveyed for herpetological diversity rank among the areas with the country's most diverse herpetological communities (Brown *et al.* 2000a; Siler *et al.* 2011). Before informed, biologically sound conservation measures are to be effective, a fundamental understanding of the ecology and patterns of distribution of Luzon's biodiversity will be necessary (Brown and Diesmos 2009; Diesmos and Brown 2011). In the absence of actual, appropriate, field-based empirical survey data, conservation status assessments (IUCN 2010) and priority setting exercises (Diesmos *et al.* 2002; Diesmos and Brown 2011) will be incomplete, uninformed, and, as such, may fail to accurately incorporate the biological reality of the species they strive to protect (Crombie 1992).

Table 1. Amphibians (anurans) and reptiles (lizards and snakes) from Ilocos Norte Province and surrounding provinces together making up the northern Cordillera Mountain Range, of Luzon Island. N = major new species distribution record (for Ilocos Norte or surrounding provinces) observed during this study; H = historical records based on vouchered museum specimens or previously published accounts (see Material and Methods). "W. Cagayan" refers to records limited to the north coastal strip of extreme western Cagayan Province (north of Apayao Province; Figure 1). * = Luzon faunal region (Brown and Diesmos, 2002, 2009) endemic species or subspecies.

	ILOCOS NORTE	APAYO	KALINGA	ABRA	W. CAGAYAN
AMPHIBIA					
Bufonidae					
Rhinella marina (Linnaeus, 1758)	N				
Ceratobatrachidae					
Platymantis cagayanensis Brown, Alcala, and Diesmos, 1999*	N	H			H
Platymantis corrugatus (Duméril, 1853)*	N		H		
Platymantis cornutus (Taylor, 1922)*	N		H		
Platymantis polillensis (Taylor, 1922)*	N				
Platymantis pygmaeus Alcala, Brown, and Diesmos, 1998*	N		H		
Platymantis sp. 1 "Shek-shek"*	N		H		
Platymantis sp. 2 "See-yok"*	N		H		
Dicroglossidae					
Fejervarya moodiei (Taylor, 1920)	N				
Fejervarya vittigera (Wiegmann, 1834)	N			H	
Hoplobatrachus rugulosus (Wiegmann, 1834)	N				
Limnonectes macrocephalus (Inger, 1954)*	N	H	H		
Limnonectes cf *woodworthi* (Taylor, 1923)*	N				N
Occidozyga laevis (Günther, 1859)	H		H		H
Microhylidae					
Kaloula kalingensis Taylor, 1922*	N	H	H		
Kaloula rigida Taylor, 1922*	N				N
Kaloula picta (Duméril and Bibron, 1841)	N				
Kaloula pulchra Gray, 1825	N				
Ranidae					
Sanguirana igorota (Taylor, 1922)*	N		H		
Sanguirana luzonensis (Boulenger, 1896)*	N	H	H		
Hylarana similis (Günther, 1873)*	N	H	H		
Rhacophoridae					
Philautus surdus Peters, 1863	N		H		
Polypedates leucomystax Gravenhorst, 1829	N		H	H	
Rhacophorus pardalis Günther, 1859	N		H		
REPTILIA (Lizards)					
Agamidae					
Bronchocela marmorata Gray, 1845*	N		H		
Draco spilopterus (Wiegmann, 1834)	N		H		H
Gekkonidae					
Cyrtodactylus philippinicus (Steindacher, 1867)	N				
Gehyra mutilata (Wiegmann, 1834)	N		H		
Gekko gecko Linnaeus, 1758	N				
Hemidactylus frenatus Duméril and Bibron, 1836	N				
Lepidodactylus lugubris (Duméril and Bibron, 1836)	N				
Scincidae					
Brachymeles bonitae Duméril and Bibron, 1839*	N		H		
Eutropis multicarinata borealis Brown and Alcala, 1980*	N				
Eutropis multifasciata (Kuhl, 1820)	H				H
Lamprolepis smaragdina philippinica Mertens, 1829	N				
Lipinia pulchella levitoni Brown and Alcala, 1980*	N				
Pinoyscincus abdictus aquilonius (Brown and Alcala, 1980)*	N		H		
Parvoscincus decipiens (Boulenger, 1895)*	N				
Parvoscincus leucospilos (Peters, 1872)*	N				
*Parvoscincus steerei (*Stejneger, 1908)	N		H		
Varanidae					
Varanus marmoratus (Wiegmann, 1834)*	N				

Table 1. ***Continued.***

	ILOCOS NORTE	APAYO	KALINGA	ABRA	W. CAGAYAN
REPTILIA (Snakes)					
Acrochordidae					
Acrochordus granulatus (Schneider, 1799)	N				
Colubridae					
Ahaetulla prasina preocularis (Taylor, 1922)	N				
Calamaria gervaisi Duméril and Bibron, 1854	N				
Coelognathus erythrura manillensis Jan, 1863*	N				
Dendrelaphis luzonensis Leviton, 1961*	N			H	
Dendrelaphis marenae Vogel and Van Rooijen, 2008	N				
Gonyosoma oxycephalum (Boie, 1827)	N				
Lycodon capucinus (Boie, 1827)	N				
Psammodynastes pulverulentus (Boie, 1827)	N				
Ptyas luzonensis (Günther, 1873)	N				
Rhabdophis spilogaster (Boie, 1827)	N				
Elapidae					
Naja philippinensis Taylor, 1922	N				
Lamprophiidae					
Oxyrhabdium leporinum leporinum (Günther, 1858)*	N		H		
Viperidae					
Trimeresurus flavomaculatus (Gray, 1842)*	N				
Boidae					
Broghammerus reticulatus (Schneider 1801)	N				
Typhlopidae					
Ramphotyphlops braminus (Daudin, 1803)	N		H		
REPTILIA (Turtles)					
Bataguridae					
Cuora amboinensis (Daudin, 1802)	N				

Acknowledgments: We thank the Protected Areas and Wildlife Bureau (PAWB) of the Philippine Department of Environment and Natural Resources (DENR-PAWB Manila), and DENR Regional Office in San Fernando, La Union and the DENR Office in Bangui, Ilocos Norte for their administrative support of this study. We thank J. de Leon, A. Tagtag, C. Custodio, A. Manila, and T. M. Lim (PAWB) for their enthusiastic support of our research program. We are grateful to the people of Adams and Pagudpud, Ilocos Norte, for their hospitality and support; in particular we thank Adams Mayor E. Bawingan, B. Waley, and I. Tusnoy of the Bugnay Winery for their hospitality and pleasant company during our stay in Adams. We thank A. Campbell (University of Kansas Biodiversity Institute), J. Rosado (Museum of Comparative Zoology, Harvard University), J. Vindum (California Academy of Sciences), A. Resetar (Field Museum of Natural History), A. Wynn (Smithsonian Institution), S. Rogers (Carnegie Museum), and V. Palpal-latoc, J. Barns (National Museum of the Philippines) for access to data and specimens in their care. We are grateful to P. Hosner, C. Aragoza, L. Baldoria, A. Fermin , L. Gabayeron, and R. Venturina for sharing information and photographs and E. Simeon, R. Madulid, and B. Maningas for their assistance with the Ilocano abstract presented in this paper. Special thanks are extended to our field collaborators J. and W. Bulalacao, J. Cantil, N. Antoque, and V. Yngente, without whose dedicated and tireless efforts this study would not have been possible. Funding for this work was provided by a U.S. National Science Foundation Biotic Surveys and Inventories grant (DEB 0743491) to RMB.

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KAIBAGASAN (ILOCANO ABSTRACT): Daytoy iti mangipaakammo nga adda 58 nga klase ti tukak, alutiit ken uleg iti 20 nga lugar ditoy kabanbatayan ti Ilocos Norte. Amin dagitoy ket makaited iti kinapateg iti lugar nga Ilocos Norte. Kas naammuan ti IUCN, naipakita nga masapulen nga sukatan iti panagkonserba kadagitoy nga ayayup. Mapanekenekan daytoy nga pinagadal nga kurang iti datus nga maipanggep iti pannakawaras ken no kasano iti panangisalba kadakuada iti mabayag nga panawen. Tikaadu nga klase ti tukak, alutiit, ken uleg ditoy Ilocos Norte ken kakurangan ti datus maipanggep kadagitoy nga ay-ayup, adu pay iti mabalin nga maadal nga manglukat iti ad adda nga pannakaawat iti kinapateg dagitoy nga nabiag ditoy Ilococ Norte.

RECEIVED: October 2011
ACCEPTED: May 2012
PUBLISHED ONLINE: June 2012
EDITORIAL RESPONSIBILITY: Olivier S. G. Pauwels